Chemical & Engineering NEWS

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Natural-gas-based petrochemicals: profitability faces tricky year

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A C&EN Key Chemicals Review

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Cover: W. R. Grace & Co.'s ammonia/urea complex at Memphis

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FOURTH-QUARTER EARNINGS VARY WIDELY

Fourth-quarter 1979 earnings performance from 16 basic chemical companies that have reported thus far varies widely. They range from Monsanto's 59% drop in fourth-quarter profits from the same period last year to Texasgulf's 195% increase.

Combined, the 16 companies show an average 19.4% increase in after-tax earnings on a sales increase of 19.3% for fourth-quarter 1979 over fourth-quarter 1978.

For the full year, the 16 companies show an outstanding earnings gain of 37.5% over the full year of 1978. Sales for 1979 increased a much slower 20.2%.

However, the blush may be off the rose. The two companies that have reported declining earnings for the quarter—Celanese and Monsanto—attribute much of their problems to their fibers operations. In previous recessions, fibers have led the downturn and a decline in this area now could portend things to come for other chemicals.

John D. Macomber, president and chief executive officer of Celanese, says that the company's chemical business sustained its favorable performance in the fourth quarter and turned in a record year. Celanese had fourth-quarter declines in U.S. sales of cellulosics and in the international portions of its fibers business. Despite this, Macomber says, these areas registered healthy full-year results. Polyester, nylon, plastics, and specialties continued to be affected by weak product demand, according to Macomber.

Monsanto chairman and president John W. Hanley sounds optimistic in the face of a gloomy report. "We believe we made progress in positioning Monsanto to capitalize on the profit growth for the decade of the 1980's, despite the fact that 1980 itself will be affected by the recessionary factors that became so apparent to us late in the fourth quarter of 1979," Hanley says.

Inventories are beginning to be a problem at Monsanto. According to Hanley, "During the fourth quarter, inventory corrections by our customers resulted in a significant drop in shipments and a modest buildup in inventory at our own plants. Products for the automotive and residential construction industries in the U.S. were particularly hard hit. Concurrently, high feedstock and raw material costs placed heavy pressure on profit margins."

High raw material costs are a problem even for those companies that have shown profit increases for the fourth quarter. At Hercules, which had an 8% increase in earnings in the fourth quarter, Alexander F. Giacco, president and chief executive officer, says, "As a result of the spiraling costs of raw material and energy in the fourth quarter, gross profits and pretax earnings were adversely affected. For the year as a whole, raw material costs were up 15.7% and energy costs were up 20.9%.

Even at Rohm & Haas, which had a 39% increase in earnings for the fourth quarter, feedstock costs were a concern. Board chairman Vincent L. Gregory Jr. says that feedstock costs were up 27% over fourth-quarter 1978.

One company still holding up well is Union Carbide, whose earnings held up longer than those of other major chemical companies in the previous recession in 1974 and 1975. Carbide reports an earnings jump of 28% before nonrecurring items in the fourth quarter on a 15% sales increase. For all of 1979, company earnings rose 51% and sales gained 17%.

In another announcement, Carbide spokesmen told security analysts last

Earnings declined at Celanese and Monsanto in fourth quarter

	Fourth-quarter 1979						Full-year 1979					
					After-tax income as % of sales						After-tax income as % of sales	
$ Millions	Sales	Change from 1978	Earnings[a]	Change from 1978	1979	1978	Sales	Change from 1978	Earnings	Change from 1978	1979	1978
Air Products	$ 317.4	15%	$ 31	42%	9.8%	8.0%	$1271.7	18%	$106.6	33%	8.4%	7.5%
Akzona	275.6	23	6.9	25	2.5	2.4	1012.4	17	25.6	23	2.5	2.4
Celanese	814.0	18	29.0	−17	3.6	5.1	3146.0	21	143.0	28	4.5	4.3
Diamond Shamrock	666.1	40	58.5	27	8.8	9.7	2351.6	29	178.1	28	7.6	7.7
Ethyl Corp.	431.1	14	22.0	8	5.1	5.4	1657.0	16	97.5	18	5.9	5.8
First Mississippi	61.4	44	5.5	b	9.0	b	237.4	51	14.8	2860	6.2	0.3
Freeport Minerals	130.3	59	26.0	177	20.0	11.5	487.7	60	101.4	224	20.8	10.3
Hercules	596.0	18	26.8	8	4.5	4.9	2350.0	21	144.5	40	6.1	5.3
International Minerals & Chemical	443.5	28	37.8	35	8.5	8.0	1642.5	17	140.0	24	8.5	8.1
Monsanto	1547.9	19	18.2	−59	1.2	3.4	6195.2	23	338.4	12	5.5	6.0
Olin	441.0	8	15.5	5	3.5	3.6	1800.0	14	71.1	13	4.0	3.9
Pennwalt	283.3	22	11.9	13	4.2	4.5	1079.3	17	48.0	7	4.4	4.9
Rohm & Haas	387.8	26	18.2	39	4.7	4.2	1590.5	27	95.5	65	6.0	4.4
Stauffer Chemical	369.7	14	35.9	6	9.7	10.4	1526.2	15	136.0	8	8.9	9.5
Texasgulf	220.3	29	44.2	195	20.0	8.8	789.3	31	136.9	173	17.3	8.3
Union Carbide	2396.0	15	131.9	28	5.5	4.9	9176.2	17	556.4	51	6.1	4.7

a After-tax, before extraordinary or nonrecurring items. b Deficit.

week to expect a large nonoperational gain in earnings in 1980, about $343 million or $5.15 per share, as a result of four major accounting changes. Well over half of this, $214 million or $3.23 per share, comes from catching up with accumulated deferred investment tax credits. □

Airco develops solvent recovery system

Metal, wood, plastics, and paper coating plants may be spared the need to convert to radiation-cured, high-solids, or water-based coatings systems if a newly introduced solvent recovery system proves economically feasible with existing conventional coatings.

Airco Industrial Gases, a division of Airco, Murray Hill, N.J., has developed a technique to condense more than 99% of solvents from curing oven effluent with liquid nitrogen while using nitrogen gas to maintain inert atmospheres in ovens. Equipment can be fitted to existing ovens.

Airco Industrial Gases polymers and coatings manager Donald Rothchild says the system virtually eliminates stack emissions, allowing conventional plants to operate within air quality standards. He estimates coaters can save 40 to 90% of present costs by using less energy to heat ovens and plant air and by taking a credit for recovered solvent. Cost savings are only 40% with massive, metal parts of high heat capacity but can rise to 90% with paper or plastics coatings. Solvent credits vary according to whether solvent can be resold or used as fuel.

The company also is exploring uses of the system in production of synthetic rubber, polypropylene, and vinyl chloride.

One key to the technology is ability to maintain solvent partial pressures of several hundred millimeters of mercury in nitrogen recirculated at high velocity through the oven and bled at a low rate to the condensation section. Conventional ovens draw 10,000 cu ft of plant air into the oven per gallon of solvent to dilute solvent vapors below explosion limits. These air volumes must be replenished from outdoors and heated.

Evaporation of liquid nitrogen from solvent condensation furnishes nitrogen gas to maintain the inert atmosphere by injection into oven entry and exit ports. Because evaporation of liquid nitrogen produces more than the needed amount of gas, the excess, blowing from the entry and exit, stops air from getting in.

Airco Industrial Gases will license the technology to other manufacturers. The firm itself will start producing 120 gal-per-hour modules in April and 45 gal-per-hour units in May. A 350 gal-per-hour system will be available on receipt of special orders.

In a trial of the process on one 18,000 sq-ft-per-hour fabric coating line of a New England textile plant, cost savings were more than 70%, Airco Industrial Gases engineers estimate. They calculated savings of 80 cents per hour for elimination of 160,000 Btu per hour previously needed to heat plant air; reduction of oven heating costs to $1.80 per hour from $3.75 per hour by lowering power consumption to 36 kw per hour from 75 kw per hour; and a credit of $6.30 per hour for 9 gal per hour of recovered solvent. Costs increased 30 cents per hour for the 300 cu ft per hour of nitrogen used. □

Higher prices will account for most chemical growth this year

$ Billions	Value of shipments 1980	Value of shipments 1979	% change 1980 Actual	% change 1980 Real[a]
Organics	$37.3	$33.9	10.1%	2.9%
Drugs	17.9	16.1	11.6	4.2
Plastics	18.9	16.5	14.5	5.0
Inorganics	14.2	12.6	13.0	3.1
Cosmetics	9.0	8.1	12.0	4.8
Fertilizers[b]	8.1	6.5	25.1	8.0
Coatings	8.0	7.5	7.0	0.5
Detergents	7.3	6.4	14.0	3.5
Pesticides	3.7	3.3	14.0	3.0
Synthetic rubber	3.0	2.9	2.2	−5.2

a Adjusted for changes in selling prices. b Nitrogen and phosphate fertilizers only. Source: Department of Commerce

Higher prices to spark 12% gain for chemicals

Despite an expected slowdown in overall economic growth in 1980, shipments of chemical products will continue to rise sharply. That, at least, is the way industry analysts in the Department of Commerce see it.

Last year, shipments of chemicals and allied products increased nearly 17% to $152 billion. This year, the department looks for a further increase of at least 12% (to $170 billion) and perhaps as much as 22% (to $185 billion). This despite the overriding assumption that the U.S. economy as a whole will contract during the first half of the year and recover only slowly during the second half, after adjustment for inflation.

The growth projected for chemicals is more a matter of higher prices than increased production, however. This is clear when you look at forecasts, published in the 1980 edition of Commerce's annual "U.S. Industrial Outlook" publication, for individual product lines. In general, growth in shipments measured in constant dollars will be only a third or less as great as when measured in current dollars. Even so, synthetic rubber is the only segment of the chemical industry for which Commerce expects output to decline this year.

Among chemicals, prospects for 1980 look strongest for nitrogen and phosphate fertilizers, both expected to show real growth of 8%. But Commerce's forecast was made before the Administration embargoed grain shipments to the Soviet Union and hinges to a considerable degree on increased exports of both agricultural products and fertilizer materials to the U.S.S.R. Other forecasts also may be a bit optimistic; most of them were made last fall when Commerce industry analysts admittedly "envisaged a stronger economy in 1980 than now appears to be in prospect." □

Ammonia imports to be limited from U.S.S.R.

Reversing an earlier decision, President Carter last week imposed a one-year, 1 million ton quota on anhydrous ammonia imported from the U.S.S.R.

Ammonia is imported under a long-term agreement between the Soviet Union and Occidental Petroleum, Los Angeles. Under the agreement, increasing quantities of ammonia were to be imported over the next several decades. In exchange, Occidental was to export to the Soviet Union 1 million tons of superphosphoric acid per year for the next 18 years. The Carter Administration is now considering a possible termination of phosphoric acid exports, a cutoff that would cost Occidental more than $160 million this year.

On Dec. 11 when Carter, overruling the U.S. International Trade Commission, decided that it was in the national interest not to impose import quotas on ammonia, Occidental contracted with the Soviets for a 47% addition to these imports. This year, the new import total was to have been 1.4 million tons, up from 950,000 tons in 1979. Last year's imports were valued at about $100 million.

Last October ITC recommended that ammonia import quotas be set for three-year periods. ITC believed then that a rapid increase in imports

Profits test due for gas-based petrochemicals

After better than expected sales and earnings in 1979, conditions may be tougher in 1980 for ammonia, urea, methanol, and formaldehyde

The leading U.S. petrochemicals based predominantly on natural gas—ammonia, urea, methanol, and formaldehyde—are in many respects the lightweights of the petrochemical world. They are smaller in molecular size, commercial sales and profits, and price structure than their glamorous distant cousins, the olefins and aromatics such as ethylene and benzene derived more from oil.

This distinction is no less true in the uses of the two petrochemical groups. The olefins and aromatics go largely into relatively high-value polymers such as the leading plastics, fibers, and rubber. The gas-based group, by contrast, winds up in two main lower-value markets, fertilizer and polymeric adhesives, whose leading outlet is in construction materials.

Du Pont's new complex at Deer Park, Tex., has 200 million gal methanol capacity

Both petrochemical groups felt fully the moderate physical growth and meteoric dollar growth of the 1970's, and both face a rougher business climate in 1980 than in 1979. However, the slope of the 1970's rise and the difficulties looming in 1980 differ considerably for oil- and natural-gas-based chemicals. For an immediate 12-month outlook on the four gas-based Key Chemicals, see the following pages. A similar outlook on five leading oil-derived Key Chemicals appeared in C&EN, Nov. 19, 1979, page 10.

For both groups of petrochemicals, 1979 turned out far better than expected. Although the ingredients of a business slowdown and resulting cost-price squeeze seemed close a year ago, a fresh buying wave from U.S. consumers and non-U.S. export markets sent petrochemicals to new heights as the year unfolded.

For the four leading gas-based petrochemicals, combined production growth in 1979 was 4.7% to 61.8 billion lb instead of falling 2% as had been feared at the beginning of the year (C&EN, Jan. 22, 1979, page 10). Average unused nameplate capacity shrank from 23% in 1978 to 18% in 1979, and for three of the four chemicals—ammonia, urea, and methanol—effective capacity use reached high levels in operating plants.

The high operating rates helped producers pull up prices, which rose a combined 33% in 1979 from 1978 to an average of 5.7 cents a lb. For 1980, if producers barely pass through expected increases in natural gas costs, prices will rise another 19% to an average of 6.8 cents a lb. The ability to do this in the face of a possible recession in the U.S. is the biggest worry for producers. Any shortfall could cut into profits.

In total production value, the four gas-based petrochemicals rose 37% in 1979 from 1978 to $3.53 billion. In 1980, the rise could be another 22% to $4.3 billion.

The dollar figures for the four gas-based petrochemicals are telling evidence of the general difference in business from the oil-based group. Although physical volume for the two groups was not much different in 1979—61.8 billion lb production for the gas-based chemicals and 65.8 billion lb for the oil-based group—the oil-based chemicals were worth more than three times as much. Production value of the oil-based chemicals came to $11.3 billion, compared to $3.53 billion for the gas-based group. The value rise in 1979 from 1978 was 37% for the gas-based group and 39% for the oil-based group.

Prices show a similar divergence. The average price of 5.7 cents a lb for the gas-based chemicals looks like a bargain beside the average 17.1 cents a lb for the oil-based petrochemicals. Prices for the oil-based chemicals rose 26% in 1979, a bit less than the average 33% rise for the gas-based group.

Although natural-gas-based chemicals kept pace in dollar terms with oil-based petrochemicals in 1979, performance gains for the 1970's as a whole were considerably less. From 1969 through 1979, the gas-based group climbed a combined 54% in production, 326% in value, and 185% in price. Although this isn't small, it pales beside the corresponding gains for oil-based petrochemicals—81% in production, 680% in value, and 328% in price.

To some extent, the lesser dollar rise for natural-gas-based chemicals results from the difference in raw material cost increases. Although all such costs soared in the 1970's, cost of natural gas went up less on average than that of oil. Oil-based chemicals such as ethylene have reflected this disparity, as natural gas liquids have been substituted as much as possible for oil-based naphtha as feedstock in the newer heavy-liquids cracking plants.

Although their advantageous cost theoretically might give natural-gas-based chemicals some market edge over oil-based chemicals, little practical market share has changed hands. One example is the growing shift to methanol from ethylene as the source of acetic acid. However, for the most part, end products are simply too different in the two groups, and future natural gas supplies too uncertain. Hence, lack of assured natural gas may block low-cost plants for ammonia and methanol just as it has for ethylene and propylene.

William Fallwell, C&EN New York, and Bruce Greek, C&EN Houston

Key Chemicals

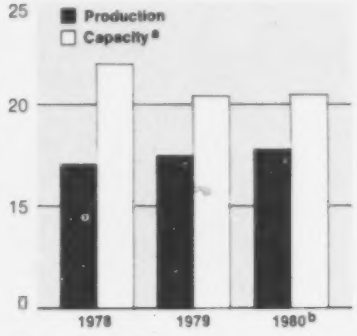
Ammonia

NH_3

- ***Demand unsettled***
- ***Capacity flat***
- ***Prices well up***

PRODUCTION/CAPACITY

Millions of tons as NH_3



a First quarter. b Excluding up to 15% additional capacity presently shut down but operable if economic conditions improve.

HOW MADE

Catalytic reaction of nitrogen from air and hydrogen made by reforming natural gas (methane)

MAJOR DERIVATIVES

Nitric acid 20%, urea 20%, ammonium phosphate 15%

MAJOR END USES

Fertilizer 80%; plastics, resins, and fibers 10%; explosives 5%

FOREIGN TRADE

Exports—rising to about 500,000 tons in 1980; imports—rising to more than 1.5 million tons

PRICES

$120 a ton at plants

COMMERCIAL VALUE

$2 billion for total 1980 production, $1.8 billion in 1979

An improving year for ammonia in the U.S. suddenly has dissolved in suspense after the government's cutoff of most of this year's grain shipments to the Soviet Union. As a result, forecasting ammonia demand in its dominant use, fertilizer, can only be called a game.

U.S. ammonia production still could rise to nearly 18 million tons in 1980 from last year's 17.5 million tons if the heavy political winds set up side currents. That is, if U.S. grain shipments blocked from the Soviet Union find other international markets, if as a result U.S. grain prices don't weaken too much, if planted acreage in the U.S. doesn't fall sharply, if U.S. longshoremen don't block the remaining grain shipments to the Soviet Union, and if—as it now appears—ammonia imports to the U.S. will be curbed, especially from the Soviet Union. President Carter has effectively pruned Occidental Petroleum's planned 1980 ammonia imports from the Soviet Union from 1.4 million metric tons to 1 million metric tons.

One of the few sure things about ammonia is that prices will rise as raw material natural gas (methane) costs increase. But producers wonder whether price rises will cover increases in production costs. So far, ammonia prices have managed a fair recovery from their severely depressed levels a year ago, moving up about 50% to $120 per ton.

Another sure thing for ammonia is that plenty of U.S. plant capacity exists if economic incentives lure it all into operation. Put most conservatively, if production slips to 17 million tons in 1980, considered in the industry a floor level, capacity use will barely exceed 70% of an estimated 24 million tons of operable nameplate capacity. This capacity includes up to 15%, or 3.6 million tons, currently shut down, leaving operating capacity at 20.4 million tons. More liberally, if 1980 production reaches 17.8 million tons, the use rate would be 87% of operating capacity.

Ammonia use continues to rise faster than production. The gap between the two will stay filled by imports, which come not only from the Soviet Union but from Canada, Mexico, and Trinidad, among other sources. U.S. consumption probably will exceed 20 million tons in 1980 unless farmers cut fertilizer use drastically or fertilizer exports drop suddenly.

The trade balance in ammonia is more complicated than it seems from ammonia figures alone. More than 10% of ammonia use in the U.S. goes to products eventually exported. Most of these are fertilizer, particularly diammonium phosphate and urea, in addition to basic ammonia.

During the fertilizer year ended June 30, 1979, exports of nitrogen-containing fertilizer apparently exceeded imports, including ammonia, based on nitrogen content. In terms of nitrogen, more than twice the amount of diammonium phosphate was exported than of third-ranking anhydrous ammonia. Urea is the largest nitrogen-containing export.

During the current fertilizer year, exports have been forecast to hold at about last year's level, more than 2 million tons of nitrogen. The reason for the leveling off is basically one of supply. Production of urea is running at practical plant capacity on an annual basis. Diammonium phosphate production appears limited by availability of raw material phosphoric acid.

The favorable trade balance in nitrogen for the U.S. will drop, although possibly not disappear, during calendar year 1980 because of higher ammonia imports. If Soviet imports are further curbed and if prices for U.S.-made ammonia rise substantially, the balance could remain positive for another year.

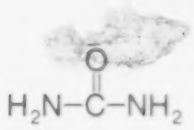
U.S. sales of fertilizer containing nitrogen could fall during 1980, depending on prices of fertilizer and grain. Increasing costs of natural gas certainly will cause some price increase for fertilizer containing nitrogen. But if grain prices hold or slump, farmers are likely to defer buying fertilizer.

The change in ammonia and grain prices can't always be translated into fertilizer sales, but one industry source estimates that a 10% rise in the price of nitrogen in fertilizer and a 10% decline in corn price could mean a 10% decline in unit (physical, not dollar) volume in fertilizer.

However, taking into account the difficult price situation in grain, prices of nitrogen in fertilizer may not rise 10%. The result then could be another year of less than satisfactory profits for U.S. ammonia producers.

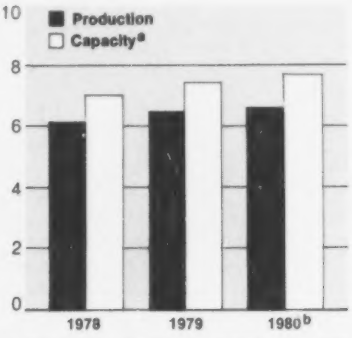
Key Chemicals

Urea



- ***Demand strong***
- ***Capacity limited***
- ***Prices well up***

PRODUCTION/CAPACITY



a First quarter. b Excluding up to 5% additional capacity presently shut down but operable if feedstock ammonia and carbon dioxide become available economically

HOW MADE

Reaction of ammonia and carbon dioxide under pressure

MAJOR DERIVATIVES

Urea-formaldehyde resins 10%, melamine resins 5%

MAJOR END USES

Fertilizer 75%, adhesives and plastics 15%, animal feeds 5%

FOREIGN TRADE

Exports—up to about 1.8 million tons; imports—up to about 1.6 million tons

PRICES

From $130 for fertilizer grade to $175 per ton for industrial grade; spot prices close to contract

COMMERCIAL VALUE

$900 million for total 1980 production, $780 million in 1979

Urea producers in the U.S. ended 1979 with operations running all out and expect the same in 1980. Production of this favored fertilizer material again will be slightly limited by availability of raw material carbon dioxide and ammonia but probably will increase slightly. Output of urea could be 6.6 million tons this year following 6.5 million tons in 1979.

In contrast to ammonia, more urea could be sold if producers could make it. Production continues to push capacity ceilings because of good U.S. demand for solution fertilizer, most often UAN's (urea-ammonium nitrate), and because of booming exports.

In 1980, barring any major decline in U.S. fertilizer use or a collapse in exports, urea plants will be run at about 80% of total nameplate capacity of 8.2 million tons. This includes about 500 million tons not operating for lack of economical raw materials. A more realistic rate of capacity use in plants actually running would be 86%.

This operating rate is considered high, given urea's dependence on ammonia in recent years. An even higher operating rate might be possible but would require either more ammonia production, not necessarily desired, or an outside source of carbon dioxide, usually too expensive.

Actually, an 86% operating rate would be something of an achievement in 1980. Besides the carbon dioxide problem, plant maintenance concerns producers. Because of the export market, in 1979 producers shifted production up and down, in relation to seasonal demand for fertilizer, less than is usual. Some maintenance pauses were skipped. As a result, in 1980 deferred maintenance could take out more capacity than might usually be expected, depending on what problems turn up in equipment when plants are finally shut down for inspection.

In compensation, some upside flexibility exists in capacity of certain urea plants that have a relatively large output of solution fertilizer as the final product. On balance, with a nod toward conservatism in the face of an uncertain fertilizer sales year, market sources estimate a small increase in urea production as probable for 1980, perhaps 2 to 3%.

Behind some of urea's strong business is increased market share. Urea-containing fertilizer solutions and solid fertilizer urea, the latter sold usually as "prills" or small granules, continue to take some of the final market for nitrogen-containing fertilizer away from anhydrous ammonia and ammonium nitrate. Ammonia, even though it has a higher nitrogen content, suffers from shipping accidents and equipment cost in application. A further advantage for urea in some forms is slow (controlled) release of nitrogen.

Solid urea also is gaining slowly in its share of the nitrogen fertilizer used to make bulk blends along with fertilizer containing phosphorus and potassium, the other two principal plant nutrients. However, the big growth in this market is over for urea. Now growth is from a larger base and is more affected by fertilizer demand increases.

Both solid and liquid forms of urea go into animal feed. This use, something over 300,000 tons a year, has little growth forecast for 1980. Competition from other forms of protein nitrogen such as soybean meal looms as an expected damper on feed applications of urea.

Use of urea in making resins (about 15% of the total urea market) in 1979 grew instead of falling as had been widely expected. The reason was that a decline in housing, the dominant use area, came later than expected. When housing starts decline, demand for urea-formaldehyde adhesive resins in plywood and particleboard declines. Although the annual rate of housing starts now has fallen, 17% in 1979 from 1978, the ripple effect on urea for resins is barely noticeable yet. A decline in this use is again forecast for 1980, but how much is uncertain.

Various other uses of urea-containing resins, such as paper chemicals, coatings, and melamines, are forecast to have modest growth or minor declines in the 1980 U.S. economy. The net effect of these uses on urea demand will be tiny.

On balance, use of urea in resins may slip less than 10% in 1980. Such a decline actually may be welcomed by producers, since it would free some urea for the tight fertilizer and export markets.

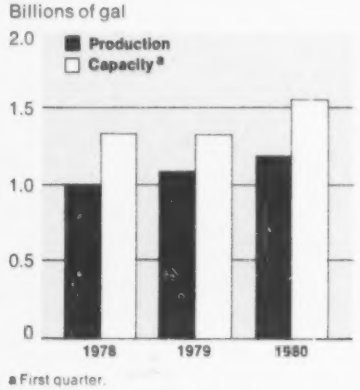
Key Chemicals

Methanol

CH_3OH

- ***Demand moving up***
- ***Capacity up modestly***
- ***Prices likely to rise***

PRODUCTION/CAPACITY



[a] First quarter.

HOW MADE

Catalytic reaction of carbon monoxide and hydrogen made by reforming natural gas or from petroleum-derived heavy hydrocarbon mixtures

MAJOR DERIVATIVES

Formaldehyde 45%, acetic acid 10%, methyl tert-butyl alcohol 5%

MAJOR END USES

Polymers used as adhesives, fibers, and engineering plastics 60%

FOREIGN TRADE

Exports—easing in 1980 to less than 40 million gal; imports—easing to about 50 million gal

PRICES

Contract 62 cents per gal at plant

COMMERCIAL VALUE

$900 million for total 1980 production, $550 million in 1979

Methanol producers in 1980 will be able to sell all they can make. Production growth therefore depends on how high capacity can be operated. That may be not so high as the official figures indicate.

Producers probably will be lucky to get a 10% production increase to 1.2 billion gal in 1980 from 1.1 billion gal in 1979, despite a 15% increase in nameplate capacity to 1.55 billion gal from a year ago.

Behind the prospect of less than a 100 million gallon addition in output this year are plant operating problems, specifically, maintenance and one plant startup.

Most methanol plants except the newest one, Du Pont's facility at Deer Park, Tex., will be shut down temporarily for maintenance, including catalyst change, sometime in 1980. The downtime could range from two to four weeks each. A simple catalyst change and minor maintenance will take two weeks. If other problems are found, the downtime can stretch out rapidly. On balance, 5 to 8% of capacity probably will be out of service during 1980.

Some of the lost production will be made up once plants are restarted. Generally, the new catalyst charge allows higher initial operating rates. However, no more than half of the lost production is expected to be made up.

The other operating problem is simply the teething of Du Pont's new plant, which uses a brand new feedstock. Du Pont is now operating its new 200 million gal-per-year methanol plant, whose raw material is synthesis gas (carbon monoxide and hydrogen) produced from heavy residues of oil refineries. But the unit has had it ups and downs. Sources outside the company say the new plant will do well in 1980 to produce at half its nameplate capacity.

If Du Pont can achieve this output, the new plant would about equal total output lost from maintenance shutdowns at other plants. It would not, however, cover any demand increases during the year.

Consumption of methanol in 1980 is expected to jump in some uses and fall off in others. The star growth market, quite spectacular, will be methyl *tert*-butyl ether, the new-generation octane-boosting additive for gasoline.

MTBE took only laboratory-sized quantities of methanol in 1978, and a very small commercial amount in 1979. Now MTBE accounts for 5% of the total methanol market and will continue to expand in 1980, reaching nearly 10% by year's end, according to some forecasters. That's a rise from close to zero to an annual rate of 120 million gal of methanol in two years.

Another use of methanol that is growing in healthy jumps is acetic acid made via carboxylation. Currently, about 10% of methanol use is in acetic acid. National Distillers will start up an acetic acid plant next to Du Pont's new methanol plant later this year using the methanol as feedstock. Longer term, as natural gas becomes more expensive, and coal possibly becomes the favored feedstock for methanol, synthesis-gas-based methanol could dominate as the raw material for acetic acid.

Less robust among methanol's major uses is formaldehyde. This use of methanol likely will decline in 1980 as formaldehyde's main outlet, home construction, slows further. This forecast was made last year as well, but the effect on methanol didn't materialize.

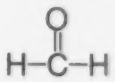
The various other uses of methanol will decline if a moderate recession takes hold in the U.S. Use in polyester fiber, for example, may be hit hard. Polyester is now beginning to slump significantly.

Such declines in methanol use in 1980 don't concern producers. New uses will take up any slack easily. As a result, methanol producers expect to be able to pass along their cost increases, particularly for natural gas, to buyers. Quarterly price increases may be the rule for 1980.

World prices for methanol continue to rise faster than in the U.S. The result is a continued slowing of imports to the U.S., since producers can get more for their methanol elsewhere.

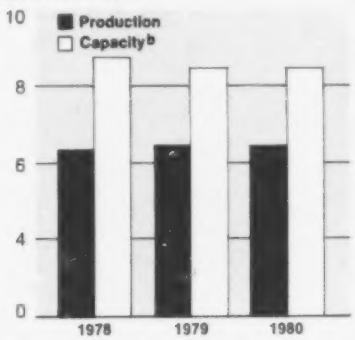
However, U.S. exports probably will remain low, 3% or so of production, because U.S. demand is firm and shipping costs are high. Exports and imports are expected to nearly balance during 1980, with a small decline in both to 40 million gal and 50 million gal, respectively. No matter, since methanol has the luxury of sold-out production in the U.S. this year.

Formaldehyde



- ***Demand to soften***
- ***Capacity adequate***
- ***Prices due up***

PRODUCTION/CAPACITY



a As a 37% solution. b First quarter.

HOW MADE

Catalytic oxidation of methanol

MAJOR DERIVATIVES

Urea-formaldehyde resins 25%, phenol-formaldehyde resins 25%, polyacetal resins 5%, butanediol 5%, pentaerythritol 5%

MAJOR END USES

Adhesives 60%, plastics 10%

FOREIGN TRADE

Exports and imports negligible

PRICES

6.2 to 7.5 cents per lb as 37% solution with variations due to location, additives, and so on

COMMERCIAL VALUE

$500 million for 1980 total production, $400 million in 1979

Toxicity will be the outside event in formaldehyde news in 1980. But for the moment, toxicity will have only a minor impact on production and use. Other factors, such as the now slumping home building market, will determine the level of production.

Overall, in 1980 formaldehyde is the only one of the four natural-gas-based chemicals in C&EN's Key Chemicals series vulnerable to a decline in production. But opinion varies widely on whether such a decline will happen. A severe recession easily could cut 300 million lb or more, about 5%, from 1979 formaldehyde production of 6.5 billion lb (sold as a 37% solution in water).

However, the effect of the recession, if one is under way, hasn't been seen yet in formaldehyde. So some producers look for as much as 200 million lb of added output during 1980.

No problem exists with capacity to make formaldehyde, which includes a large number of plants scattered through regions where wood is processed into plywood and particleboard. These two end products use formaldehyde in adhesive resins. If formaldehyde production in 1980 reaches 6.5 billion lb, plant use will be about 77% of an unchanged 8.5 billion lb of nameplate capacity. This level is considered typical for a product subject to seasonal variations in end uses.

Resins classed as adhesives account for about half of formaldehyde use, but a significant part of these resins goes to uses other than binding wood sheet or particles together. For example, about 15% of urea-formaldehyde resins, the largest single use of formaldehyde, goes into nonwood uses such as paper coatings or additives for paper and textiles. However, these smaller uses are not growing much, if at all, and so have little impact on the outlook for formaldehyde.

The fraction of phenol-formaldehyde resins that goes to nonwood binding uses is much larger than that for urea-formaldehyde resins, whose end use pattern is narrower. But again, these uses don't seem to have very large growth rates and likely will make only small increases in formaldehyde use.

Formaldehyde's large use in wood products has led to concern over its toxicity. Apparent depolymerization of the resins used in plywood and particleboard in some cases has released formaldehyde, the odor of which was noticeable in household interiors and mobile homes. Then came concern over plant workers who might have contact with formaldehyde or with its derivatives.

Toxicity research on formaldehyde has expanded rapidly over the past year. The Formaldehyde Institute, an association of producers, is sponsoring the work, as are various other groups. As yet a consistent, broad pattern of results has not developed. When enough information becomes available, and if toxicity is reasonably shown, formaldehyde could face a drastic exposure-control campaign much like the severe (and successful) clampdown on vinyl chloride in the mid-1970's. However, formaldehyde could have a rougher road because of the more fragmented nature of its production and use.

The toxicity hurdle is not expected to affect demand for derivatives of formaldehyde significantly. Formaldehyde is a very cheap material to make, with little competition, but production costs may well increase.

Consumers of products made using formaldehyde continue to fool demand forecasters. Housing has turned down but not as much as many forecasters expected. Automobile sales are off, reducing demand for derivative polyacetal resins in their largest use. However, weight-saving efforts partly offset this decline by allowing greater use per car.

Even if demand for formaldehyde declines 5% in 1980, prices hardly will be affected. Most of formaldehyde's cost comes from raw material methanol. As a result, formaldehyde prices are closedly tied to methanol's, which means to the price of raw material natural gas.

Formaldehyde prices, however, are a relatively small part of the cost of derivatives and end products, making formaldehyde's cost minor in the total end-use picture. Formaldehyde's insignificance in end-product costs may shield it from the worst in a weak housing year. Still, the product cannot hope for much more than a flat year in physical volume and may have a weighty challenge to deal with in toxicity.